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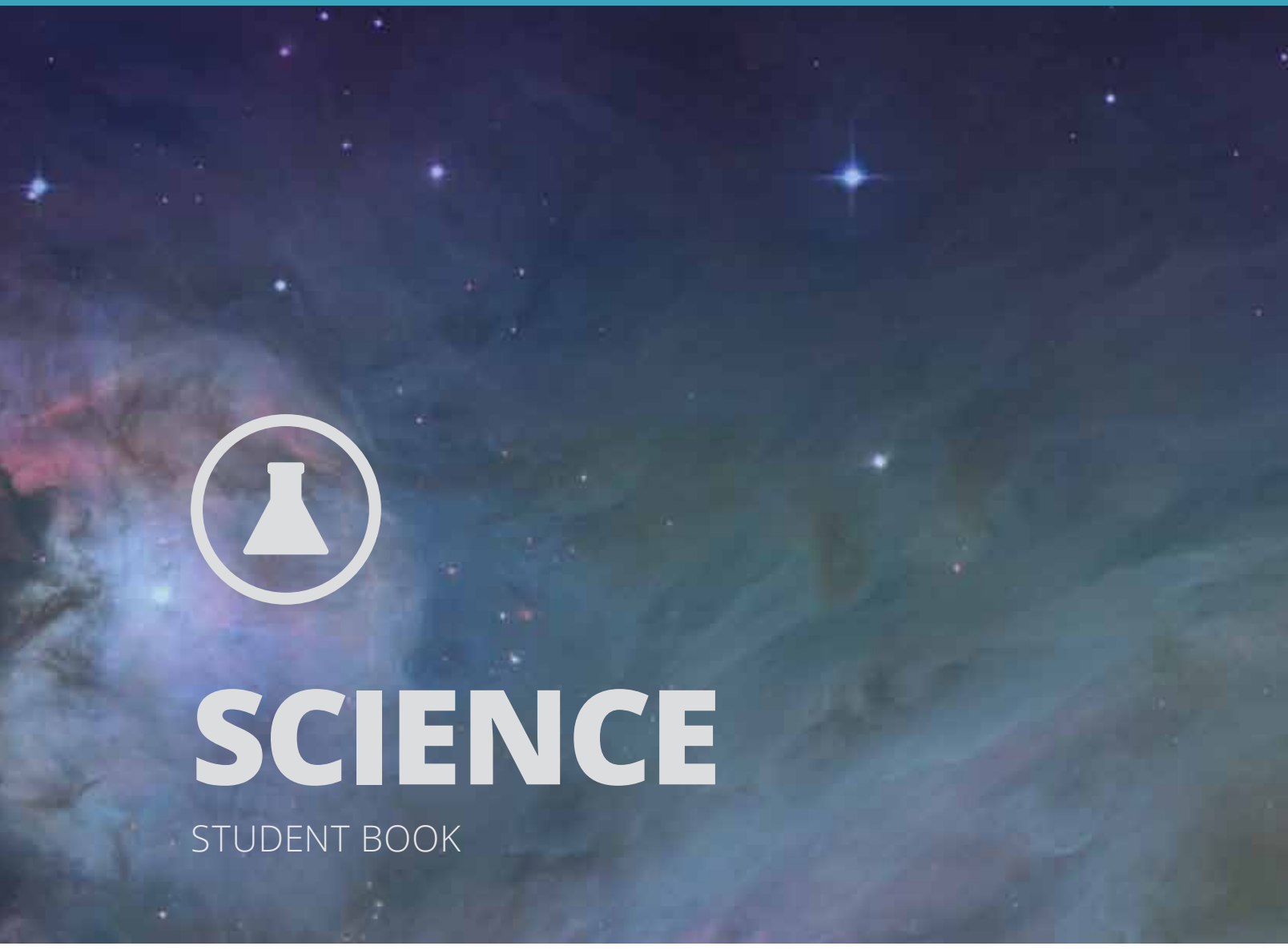

SCIENCE

STUDENT BOOK

10th Grade | Unit 1

Alpha Omega
PUBLICATIONS

SCIENCE 1001

Taxonomy: Key To Organization

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

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SCIENCE 1000 SUPPLIES

Many of the things that you will need to perform the experiments in Science 1000 can be found around the home. For instance, instead of using test tubes, you may substitute baby food jars and lids. Instead of a beaker, you may use a mayonnaise jar. Some of the things you will need to successfully perform the experiments you will just need to borrow or buy. There are resources in your area where you may be able to find these materials. Your local school may lend you a microscope or perhaps you can buy an older one from them when they purchase new ones. There may be major discount department stores in your area that sell these things for low cost. Ordering science material through the mail or over the Internet is also a possibility. With each complete boxed set of science curriculum, you should receive an order blank from a trusted supplier for science supplies in the sizes and amounts that you will need to successfully perform the experiments.

If you did not receive an order blank, call the Alpha Omega Publications Customer Services Department for more information.

A suggested support item for this course is the 10th Grade Science Experiments video, SD1001. The video includes presentations of many of the experiments in this course. Several of the experiments that require special equipment or materials are demonstrated on these videos. They can either be used for answering the questions of the lab report or as a demonstration of the procedure prior to performing the experiment. A notice is included with each experiment in the LIFEPAC where the video is available.

Remember, it is the supervisors' or parents' responsibility to make sure that all students follow proper safety procedures for experiments and lab work. Any questions that you have about chemicals or supplies should be directed to the supplier of those materials. It cannot be assumed that all necessary warnings and precautions are contained in this material.

As a Christian school curriculum publisher, we discuss what is taught and believed regarding the creation and origins of life on our planet from the Christian point of view. It is the responsibility of the family to decide what they desire to be learned by their students in the school and the home, and whether or not the biblical view is what they want to be taught. There are a number of Christian websites on the Internet, however, that may be examined to get further information on the origins of life from a biblical point of view. One of them is the Creation Research Institute website.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

Taxonomy: Key To Organization

Taxonomy is not about taxes, or even about government. Taxonomy is the science of classification and is important in such disciplines as *zoology*, *botany*, *microbiology* and *paleontology*. Taxonomy is the science of grouping living things according to their similarities or differences. Each group of similar organisms is given a name which does not apply to any other group or organism. All roses are given the name *rose*. A rose is never called a sunflower, or a grass.

Everything that moves could easily be called an animal; and everything that doesn't move, a plant. However, long ago, scientists decided that different kinds of living things require special names and classifications for man to talk about them, to study them, or simply to appreciate them. We use this science of classification every time we distinguish among a deer, a frog, and a rhinoceros: they are similar, yet they are different.

In studying similarities and differences we can see and enjoy the many wonders of God's amazing craftsmanship that otherwise might be missed. Several important reasons for studying and knowing taxonomy are given in this passage.

> We can enjoy things more, the more we know about them. Simply to be able to call the elements of beauty by their right names helps us to relive them. Intellectually to grasp an object of enjoyment is to possess it more securely. We take more pleasure in the stars if we know their names. We listen better to birds if we can distinguish them. We hear a symphony with deeper absorption if we know something of its harmonies. — Walter R. Bowie

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC®. Each section will list according to the numbers below what objectives will be met in that section. When you have finished this LIFEPAC, you should be able to:

1. Trace the historical development of taxonomy.
2. Define taxonomic principles and concepts.
3. Identify and use a system of taxa.
4. Use a taxonomic key.
5. Construct and write a key for identification purposes.
6. Distinguish between life forms.
7. Recognize variation in populations.
8. Identify members of the plant and animal kingdoms.
9. List plant and animal characteristics.
10. Distinguish between artificial and natural systems of classification.
11. Compare two models of origins.
12. Appreciate God's plan for order in the diversity of life.

1. THE HISTORY OF TAXONOMY

Someone has said the first law of heaven was that of order. To bring order out of chaos, to bring order out of great diversity, has been the goal of **taxonomy**.

To understand taxonomy, we must study its history. The history of taxonomy closely parallels the history of science. In fact, taxonomy produced many of our modern sciences.

Taxonomy was present at the beginning of human history. Some of the early ways taxonomy was used are still with us today. Taxonomy, the *organizing* science, has become a practical and necessary tool of life scientists. We will trace the birth and development of science in this section of this LIFEPAC.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Trace the historical development of taxonomy.
2. Define taxonomic principles and concepts.

12. Appreciate God's plan for order in the diversity of life.

Vocabulary

Study these words to enhance your learning success in this section.

classification	**family**	**fixity of species**
genetics	**genus**	**kind**
population	**species**	**taxonomic system**
taxonomist	**taxonomy**	**variation**

Note: *All vocabulary words in this LIFEPAC appear in* **boldface** *print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.*

BIBLICAL TAXONOMY

From his beginning, man has employed the science of taxonomy. Though it may seem to be a science of minimal significance, taxonomy is actually essential to our learning process and specifically to our understanding of God's creation. It not only determines *what* we learn but also *how* we learn. Taxonomy permits us to see similarities and differences among all of God's creation. It is a tool which adds meaning to what we learn and increases our understanding, our comprehension of God's creation.

God used the concept of taxonomy. He emphasized it in the first book of the Bible, in Genesis chapters 1 and 2. The Creation itself was organized and communicated to us by dividing the specific events into seven days.

God indicated the importance of taxonomy by giving Adam the privilege and responsibility of naming the animals. Adam became the first **taxonomist**. Adam (Genesis 2:20) "...gave names to all cattle, and to the birds of the air, and to every beast of the field..." Adam did not

name animals generally but gave every **kind** of animal a specific name. Adam was able to see the differences and similarities among all creatures and to name and classify them on that basis.

From Creation, kinds of living things have continued to reproduce similar offspring. From Genesis we know that each living thing reproduces "after its kind." This principle is basic to another science introduced in the Bible, the science of **genetics**, which studies the ways traits are passed from parent to offspring. Some creatures present at Creation have become extinct; the rest continue to reproduce organisms of the same ancestral kind. Some have produced many sizes, shapes, and varieties of those original kinds of living things, which are present today and were present at the beginning according to the Scriptures.

When Moses recorded Genesis, scientists of his day had not yet developed workable principles of taxonomy and genetics. Indeed, until about three hundred years ago, science of the Western civilization was based on myth, teaching that snakes are produced by horse hair and flies by decaying meat. In the Egypt of Moses's day, animals were even treated as gods. The principles that appear in the Bible, then, were not the result of Moses' including the knowledge of his time in his record of God's Word. God provided a model for grouping things on the basis of similarities and differences. The concepts that led to our development of scientific tools for learning, for understanding the life around us, and for increasing our awareness were written down by Moses with the authority and inspiration of the Holy Spirit.

Complete these sentences.

1.1 Taxonomy is the science that deals with _____ .

1.2 Taxonomy is necessary in other sciences such as a. _____ and b. _____ .

1.3 The first human taxonomist was _____ .

1.4 The Bible gives us the concepts leading to the development of sciences such as a. _____ and b. _____ .

1.5 When grouping and identifying living things, the **classification** is based on a. _____ and b. _____ .

1.6 Moses wrote down the concepts that led to the development of scientific tools with the authority and inspiration of _____ .

Answer these questions.

1.7 What everyday use do we make of taxonomy? _____

_____

1.8 Why should we study taxonomy? _____

_____

Explain these concepts.

1.9 taxonomy: the key to organization _____

_____

1.10 what is meant by kinds of living things _____

_____

1.11 after its kind _____

_____

EARLY HISTORY OF TAXONOMY

The history of taxonomy is important to the learner in showing the development of science. The life sciences are built on the science of classification—taxonomy. People have been classifying plants and animals for thousands of years.

Historians tell us that one of the common ways people of ancient times grouped living things was into the categories of *useful* or *harmful*. This method is a popular way of thinking about plants and animals even today. Other groupings that people commonly use are food, clothing, building, size, shape, utility, color, composition, value, danger, and the list could go on and on.

The Greek philosopher Aristotle (384-322 B.C.) was a student of nature. He classified animals into two main groups: animals with red blood and animals without red blood. He classified plants into three main groups: herbs, shrubs, and trees. Aristotle's taxonomy has been used for nearly two thousand years as a foundation for classifying. Numerous writings and works of research are credited to Aristotle, based on his teaching in the Lyceum, the center for knowledge in ancient Greece. For his work with animals, later scientists gave him the title "Father of Zoology."

Theophrastos (370-285 B.C.), a student of Greek philosophers Plato and Aristotle, was one of the first writers of plant description. His work with plants earned him the title "Father of Botany." Two of his known works are *Enquiry into Plants*, and *The Causes of Plant*s. Altogether Theophrastos wrote about five hundred different kinds of plants which he classified into four groups: trees, shrubs, subshrubs, and herbs. He also noted the differences in plant tissues and differences between flowering and non-flowering plants. Theophrastos' reputation was such that Alexander the Great in his travels and conquests sent numerous plant materials to

him to study in Athens, thus further broadening his area of knowledge.

Many fields of knowledge became dormant with the decline of the Greek civilization. The Romans were more interested in power than in knowledge. Scientific work that was done was often incomplete or inaccurate.

Pliny the Elder (A.D. 23-79) wrote about the medicinal and agricultural groupings of plants. His *Natural History*, a work of nearly forty known volumes, was one of the first books printed by movable type. The information he recorded about the known world of his day was held in reverence by the people of Europe for more than a thousand years. Much of his work, however, was copied from earlier authors, but with the unfortunate addition of a large number of myths and fables.

Dioscorides (first century A.D.), a Greek physician in the Roman army, grouped plants and natural materials useful in the treatment of disease in his work *Materia Medica*. Medicine at that time consisted mainly of herb lore and uses. He wrote about his experiences with some six hundred plants as a practicing physician. In those days anyone possessing a copy of *Materia Medica* was practically guaranteed success as a doctor.

The vast majority of taxonomy writers of ancient and medieval times merely recopied previous information. As in the children's game of "gossip" or "telephone," errors crept into the works. Few writers stopped to look at the real objects about which they wrote. Illustrations of plants, for example, often were given too many or too few petals or leaflets, or the wrong leaves for a particular kind of flower. Ironically, these recopied books were thought to be better sources of information than the real plants and the real animals.

Not until the Renaissance did writers technically describe and carefully illustrate their works. With these advances came new ways of classifying plants and animals. The ancient Greeks ceased being the only authorities in taxonomy. People became original in both the sciences and the arts as they became less dependent on Greek writings for information.

Around A.D. 1000 a Persian physician compiled a *Canon of Medicine*. Ibn-Sina (980-1037) was the author of the work which many scientists compare to Dioscorides' *Materia Medica* as one of the greatest scientific classics.

The Herbalists in the fifteenth and sixteenth centuries wrote about medicinal and agricultural uses of plants. Herbalists such as Otto Brunfels (1464-1534) wrote books with excellent illustrations, called *herbals*, which were helpful to anyone interested in identifying medical classifications of plants. One popular interpretation of this time was called the "doctrine of signatures." This popular but incorrect idea stated that the shapes of plants gave hints of their medicinal use. For example, the plant liverwort is shaped like a human liver. So an herbalist might prescribe that plant as a tea in treating liver ailments. Herbalists were known also for making up information if none could be found for a particular plant.

The development of printing and navigation created new opportunities to share information and to explore widely. Books became common and inexpensive. People were better able to read the works previously available only to the scholarly. Taxonomy grew as a science. Many plants and animals became known for the first time through books, exploration, and travel.

Valerius Cordus (1515-1544) was one of the first scientists of the Renaissance to use first-hand observations of living plants to write plant descriptions. As a result, his works are more reliable than those of many earlier scientists. In another development beginning in the seventeenth century, students and writers of taxonomy began to classify by certain features instead of by uses. Gaspard Bauhin (1560-1624), a Swiss botanist, took on the enormous task of listing all plants known at that time. He

recorded their names in his work, *Pinax*, a plant register. He was one of the first Renaissance taxonomists to use a scientific name of two words and to separate plants into groups, or categories. His work did a great deal to lessen the confusion of increasing numbers of plant names.

Taxonomy began to grow rapidly. The great number of plant and animal discoveries coming from newly explored parts of the world was becoming unmanageable. Better descriptions and better ways of identification were needed. Thus, the stage was set for a more scientific way of classifying.

John Ray (1627-1705), an English botanist, published many works. *Methodus Plantarum Nova* and *Historia Plantarum* are two of his most important writings. However, his major contribution to taxonomy was the development of a classification system that grouped plants by the ways they looked alike, not on the basis of a single plant feature or of a plant's use. The concept of **species** in classification was suggested by Ray, but a method actually using species was not developed for another fifty years.

Write true or false.

1.12 _____ In ancient times people classified plants and animals by use.

1.13 _____ Pliny experimented with medicinal plants.

1.14 _____ Dioscorides received praise as the "Father of Medicine."

1.15 _____ Scientists resumed observing and studying real plants and animals during the Renaissance.

1.16 _____ Factors in the advancement of taxonomy were travel and exploration.

1.17 _____ Ibn-Sina was the Persian physician who classified plants according to their "signatures."

1.18 _____ Bauhin, author of *Pinax*, was one of the first taxonomists to use two-word scientific names.

1.19 _____ John Ray introduced a new method of grouping by similarities in appearance.

Answer these questions.

1.20 What did Aristotle contribute to taxonomy? _____

_____

1.21 What did Theophrastos contribute to taxonomy? _____

_____

1.22 What is one difference between the ways Aristotle and Theophrastos classified plants?

_____

1.23 What was one problem of early books on taxonomy? _____

_____

1.24 For what were the herbalists known? _____

_____

1.25 How did Cordus differ from early writers? _____

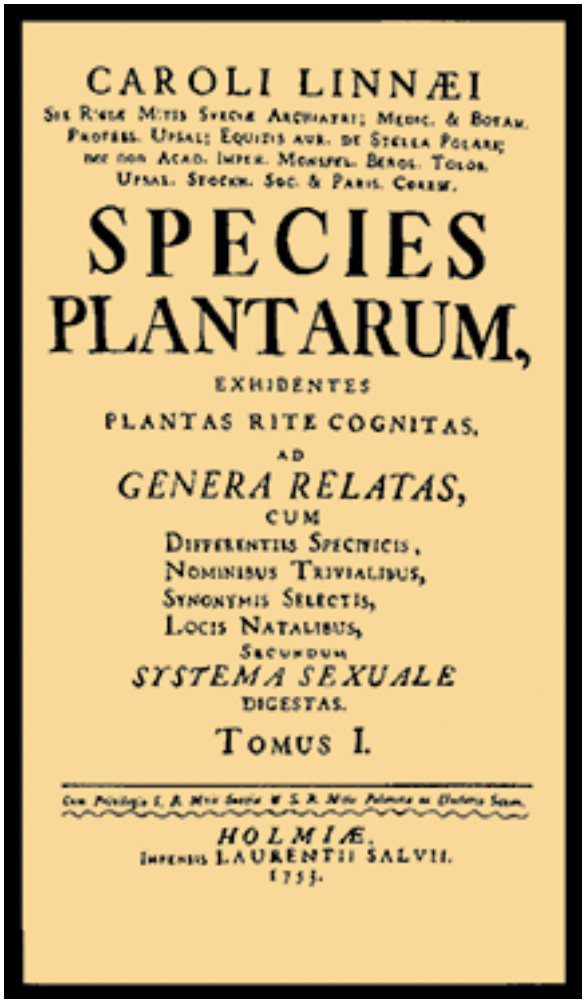
_____

BEGINNING OF MODERN TAXONOMY

Modern taxonomy begins with the work of Carolus Linnaeus (1707-1778). Because he did more than any other human to organize and to give identity to the living things of this world, he is referred to as the "Father of Modern Taxonomy." His gift for organizing and the contributions he made opened the door to the flood of scientific knowledge that followed.

Linnaeus' passion for collecting and classifying living things caused him to turn his attention from a career as a physician to researching, writing, and teaching about the many forms of life around him, especially plants. In 1732 the young Swedish botanist went to Lapland to collect plants. His diary describing the new plants was published as *Flora Laponica*. His later studies led to the publication of his two most important works, *Species Plantarum* (1753), the work singled out as the starting point for modern taxonomy, and *Systema Naturae* a listing of 4,236 kinds of animals (See Figure 1).

When Linnaeus began his work, systems of naming, classifying, and researching real plants had already begun, but Linnaeus contributed many new methods. The system of Linnaeus was so improved over other systems of his time that anyone with a little training in taxonomy could use the system and arrive at the same animal or plant identification as a highly trained taxonomist.


CAROLI LINNÆI

SPECIES PLANTARUM,

EXHIBENTES PLANTAS RITE COGNITAS, AD GENERA RELATAS, CUM DIFFERENTIIS SPECIFICIS, NOMINIBUS TRIVIALIBUS, SYNONYMIS SELECTIS, LOCIS NATALIBUS, SECUNDUM SYSTEMA SEXUALE DIGESTAS.

TOMUS I.

HOLMIÆ, IMPENSIS LAURENTII SALVII. 1753.

Figure 1 | Linnaeus' important contribution to the Science of Taxonomy

Linnaeus' system classified plants according to flower structure and considered the stamen number most significant to classification. Another important part of this system was the use of two names together in identifying an organism. This binomial system replaced the complicated classifications of earlier taxonomists. New plants could be classified, catalogued, and added to the listing with little difficulty.

Carolus Linnaeus believed in the **fixity of species** and thought he was revealing the grand design of creation by classifying each living thing according to some ideal plant or animal model. The fixity of species was a common belief of his day. This belief was a very limited view of "after its kind," a view limited by lack of evidence, lack of information, and misinterpretation. The scientific creationist's interpretation is one of **variation** within **populations** of organisms, but no changes within those populations to new kinds of organisms. Linnaeus' concept of *kinds* did not permit variation to any degree. In addition, the definition of *species* has not always been the same. Our definition of *species* is different from the one used by Linnaeus.

The present view of kinds, or species, taking into account evidence, knowledge, and information from science and the Scriptures is this: The Genesis *kinds* may sometimes be a species, sometimes several species or a **genus**, sometimes a **family**, and sometimes less than a whole species. When more information and better **taxonomic systems** are available, problems in defining terms will be easier to solve.

Complete these sentences.

1.26 The Swedish botanist who made the greatest contributions to taxonomy was

a. _____ who is known as the

b. "_____."

1.27 Two of Linnaeus' contributions were a. _____

and b. _____.

1.28 Linnaeus' two most important writings are a. _____

and b. _____.

Answer these questions.

1.29 What was the feature most significant to plant classification in the Linnaeum system?

_____

_____

_____

1.30 How did Linnaeus' concept of kinds differ from ours today? _____

_____

_____

_____

_____

1.31 Why do you think Linnaeus was successful as a scientist? _____

_____

_____

_____

_____

Create a puzzle.

1.32 Write your own puzzle using one of these four types. The subject for your clues should be "People Who Made History in Taxonomy." Have another student complete the puzzle when you have finished creating it.

1. A Word Search
2. A Crossword Puzzle
3. A Guess-Who Game (four clues per scientist)
4. Taxonomy Pictures Using Letters of Names (one picture per scientist)

TEACHER CHECK _____ initials _____ date

Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

SELF TEST 1

Match these items (each answer, 2 points).

1.01 _____ taxonomy

1.02 _____ population

1.03 _____ fixity of species

1.04 _____ kind

1.05 _____ genetics

a. Linnaeus

b. the science of living things

c. the science of heredity (inheritance)

d. the science of classification

e. a group of organisms that are capable of reproducing more of that group

f. all organisms of a kind in an ared

Complete these sentences (each answer, 3 points).

1.06 Taxonomy is the science of _____ .

1.07 Ways of grouping plants and animals in ancient times might be by a. _____ and b. _____ .

1.08 The first taxonomist was _____ .

1.09 One of the first Greek taxonomists who grouped animals by blood color and plants by size and shape was _____ .

1.010 Egyptians of Moses' day taught that snakes came from _____ .

1.011 An herbalist might use an interpretation known as _____ to suggest a plant's use for medicinal remedies by its shape.

1.012 When information was not available for a plant, the herbalists _____ _____ .

1.013 Two important developments of the Renaissance were a. _____ and b. _____ , which encouraged the growth of taxonomy and other sciences.

1.014 The "Father of Modern Taxonomy" is a name given to _____ .

1.015 Classification groupings today are made on the basis of how organisms are a. _____ and b. _____ .

Answer true or false (each answer, 1 point).

1.016 _____ Moses wrote in Genesis about the science he had learned in Egyptian schools.

1.017 _____ Taxonomy is a science of organizing and classifying.

1.018 _____ The Bible gives us no information about science.

1.019 _____ *After its kind* means *reproduction of new kinds of living things*.

1.020 _____ People have classified plants and animals for thousands of years.

1.021 _____ Scientists began to study and observe real plants and animals during the Renaissance.

Match these items (each answer, 2 points).

1.022 _____ Aristotle

1.023 _____ Theophrastos

1.024 _____ Pliny

1.025 _____ Dioscorides

1.026 _____ Ibn-Sina

1.027 _____ herbalists

1.028 _____ Cordus

1.029 _____ Bauhin

1.030 _____ Ray

1.031 _____ Linnaeus

a. herbal—a book on medical classification and identification of plants

b. grouped plants on similarities, idea of species

c. medical plant lore

d. herbs, subshrubs, shrubs, trees; flowering and non-flowering plants

e. herbs, shrubs, trees; red and nonred blood

f. medical and agricultural plants with fables

g. plant register; Pinax; used groupings and a form of scientific names

h. grouped plants by natural descent from common ancestor

i. Persian doctor; Canon of Medicine

j. two-word, scientific names; Species Plantarum

k. one of first Renaissance scientists to use firsthand observations to write about plants

Answer these questions (each answer, 5 points).

1.032 What were Linnaeus' contributions to taxonomy? _____

_____

_____

1.033 What was the difference between the study of taxonomy in Rome and in Greece?

_____

_____

_____

1.034 How did God introduce the concepts that would lead to the science of taxonomy?

_____

_____

_____

72/90 **SCORE** _____ **TEACHER** _____ _____
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